

What is claimed is:

1. An apparatus for perforating or severing a web, the apparatus comprising:

(a) a mechanism for supporting a web, the web having a first edge and a second edge, the web being adapted for travel upon the mechanism;

(b) a frame adjacent to the web;

(c) at least one laser mounted upon the frame, the laser being configured for directing a beam of light upon the surface of the web to form at least one severed portion upon the web.

2. The apparatus of claim 1 in which the apparatus is configured to sever the web continuously from the first edge to the second edge.

3. The apparatus of claim 1 in which the laser is configured to form a plurality of severed portions upon the web in interrupted sequence, enabling creation of a perforation line in the cross direction of the web, whereby bonded portions in the perforation line are positioned between severed portions.

4. The apparatus of claim 3 in which the laser is adapted to form multiple perforation lines positioned generally parallel to each other and in the cross direction of the web, in which the perforation lines are provided at spaced intervals.

5. The apparatus of claim 1 in which a plurality of lasers are employed, whereby each laser acts upon only a portion of the cross directional width of the web.

6. The apparatus of claim 5 in which the web is apportioned into a plurality of zones, said zones being positioned along the machine direction of the web, wherein a plurality of lasers are provided such that each laser corresponds to a zone upon the web, such that each successive laser is directed to provide a light beam upon a corresponding and successive zone of the web.

7. The apparatus of claim 1 in which the mechanism for supporting the web comprises an air foil.

8. The apparatus of claim 1 in which the mechanism for supporting the web comprises rollers.

9. The apparatus of claim 1 in which the mechanism supporting the web comprises a carrier fabric.

10. The apparatus of claim 9 in which the carrier fabric is capable of suspending the web at a fixed distance from the laser.

11. The apparatus of claim 1 in which the web includes a cross direction from the first edge to the second edge, whereby the laser is configured to direct the beam of light at an angle that deviates from the cross direction.

12. A system for perforating a web, the system comprising:

(a) a web conveying means adapted for supporting and conveying a web, the web having a cross direction bounded by a first edge and a second edge, the web being adapted for travel upon the surface of the web conveying means;

(b) a frame; and

(c) at least one laser mounted upon the frame, the laser being adapted for directing a beam of light upon the surface of the running web to form severed portions that form a perforation in the cross direction of the web, the perforation comprising severed portions and bonded portions in alternating sequence.

13. The system of claim 12 in which the web is apportioned into a plurality of zones, wherein a plurality of lasers are provided in an array across the web from the first edge to the second edge, such that each successive laser in the array is adapted for providing a light beam upon a corresponding zone of the web.

14. The system of claim 13 in which at least three zones are provided upon the web.

15. The system of claim 13 in which the speed of travel of the web upon the conveying means is greater than about 3,000 feet per second.

16. The system of claim 13 in which the speed of travel of the web upon the conveying means is greater than about 3,500 feet per second.

17. The system of claim 13 in which the speed of travel of the web upon the conveying means is greater than about 4,000 feet per second.

18. The system of claim 12 in which the web conveying means comprises an air foil.

19. The system of claim 12 in which the web conveying means comprises rollers.

20. The system of claim 12 in which the web conveying means comprises a carrier fabric.

21. The system of claim 12 in which the laser provides a light beam upon the web at an angle that deviates from the cross direction, but results in a severed portion that is oriented in the cross direction.

22. A method of severing or perforating a paper web, the method comprising:

(a) providing a web having a cross direction across its width and a machine direction along its length, the web being provided for travel upon a supporting mechanism;

(b) directing a beam of light from a laser upon the surface of the web;

(c) severing the web in at least one location; and

(d) thereby forming a web having a severed portion.

23. The method of claim 22 in which step (b) includes providing an array of lasers oriented in the cross direction of the web, in which said array of lasers each are directed at predetermined zones of the web.

24. The method of claim 23 in which the web is subdivided into said zones oriented along the machine direction of the web, further wherein the directing step (b) further comprises providing multiple beams of light from said laser array, wherein each successive laser in the array is configured to provide a beam upon respective and successive zones of the web.

25. The method of claim 24 in which the providing step (a) comprises providing the web at a fixed distance from the laser array.

26. The method of claim 25 in each zone of the web comprises a first edge and a second edge, further wherein the beams of light are directed to advance from a first edge of a respective zone to a second edge of said zone, whereby beams originating in successive lasers in the array are directed at respective zones upon the web surface.

27. The method of perforating a paper web, the method comprising:

(a) providing a paper web having a cross direction across its width, and a machine direction along its length, the paper web being positioned upon the surface of a moving carrier fabric;

(b) providing a laser array of multiple lasers, said laser array positioned in the cross direction to the web, wherein each laser of said array is capable of directing a light beam upon the web, further wherein each laser is assigned a predetermined zone of the paper web upon which to direct a light beam;

(c) moving the web into the path of the laser array;

(d) directing a beam of light from each laser of said array upon the surface of the web;

(e) severing the web in predetermined locations to form perforation lines in the cross direction of the paper web, each said perforation line comprising severed portions of paper web having intermediate bonded portions between the severed portions; and

(f) forming a perforated paper web.

28. The method of claim 27 in which perforations are formed in each respective zone, wherein the perforations connect to form a perforation line across the width of the paper web.